

CLAIMS

What is claimed is:

1. A method of making a capacitor, comprising:
 providing a bare metallic foil;
 5 forming a dielectric over the bare metallic foil, wherein forming
 the dielectric comprises:
 forming a dielectric layer over the foil;
 annealing the dielectric layer;
 re-oxygenating the dielectric resulting from the annealing; and
 10 forming a conductive layer over the dielectric, wherein the
 metallic foil, the dielectric, and the conductive layer form the capacitor.
2. The method of Claim 1, wherein annealing comprises:
 annealing at a temperature in the range of about 800-1050°C.
3. The method of Claim 2, wherein annealing comprises:
 15 annealing in an environment having an oxygen partial pressure
 of less than about 10^{-8} atmospheres.
4. The method of Claim 2, wherein annealing results in a dielectric
 comprising crystalline barium titanate or crystalline barium strontium
 titanate.
- 20 5. The method of Claim 1, wherein forming a dielectric layer
 comprises:
 providing a dielectric precursor solution comprising barium
 acetate and at least one of titanium isopropoxide and titanium butoxide.
6. The method of Claim 1, wherein the capacitor has a
 25 capacitance density of at least 0.5 microFarad/cm².
7. The method of Claim 1, wherein re-oxygenating the dielectric
 comprises:
 re-oxygenating the dielectric at a temperature in the range of
 450-700°C and an oxygen partial pressure in the range of 10^{-2} to 10^{-7}
 30 atmospheres.
8. The method of Claim 1, wherein providing a bare metallic foil
 comprises:
 providing a bare copper foil.
9. The method of Claim 1, wherein providing a bare metallic foil
 35 comprises:
 providing a foil that has not been treated with organic additives.
10. The method of Claim 1, wherein the dielectric layer is applied to
 a first side of the foil, the method comprising:

forming a second dielectric layer on a second side of the foil opposite to the first side.

11. The method of Claim 1, wherein forming a dielectric comprises:
forming a dielectric having a thickness in the range of about 0.2-
5 2.0 microns.
12. The method of Claim 1, wherein forming a dielectric comprises:
forming a doped dielectric.
13. The method of Claim 1, comprising:
etching the conductive layer.
- 10 14. A capacitor formed by the method of Claim 1.
- 15 15. A method of making a capacitor, comprising:
providing a metallic foil;
forming a dielectric over the metallic foil, wherein forming a
dielectric comprises:
15 annealing at a temperature of greater than about 800°C in an
environment having an oxygen partial pressure of less than about 10^{-8}
atmospheres;
re-oxygenating the dielectric; and
forming a conductive layer over the dielectric, wherein the
20 metallic foil, the dielectric, and the conductive layer form the capacitor.
16. The method of Claim 15, wherein annealing comprises:
annealing at a temperature in the range of about 800-1050°C.
17. The method of Claim 15, wherein annealing results in a
dielectric comprising barium titanate or barium strontium titanate.
- 25 18. The method of Claim 15, wherein providing a metallic foil
comprises:
providing a bare copper foil.
19. The method of Claim 18, wherein providing a bare copper foil
comprises:
30 providing a copper foil that has not been treated with organic
additives.
20. The method of Claim 15, wherein forming a dielectric
comprises:
forming a dielectric having a thickness in the range of about
35 0.2-2.0 microns.
21. The method of Claim 15, comprising:
etching the conductive layer.
22. A capacitor formed by the method of Claim 15.

23. A method of making a capacitor, comprising:
providing a bare copper foil that has not been treated with organic additives;
forming a dielectric having a thickness in the range of about
5 0.2-2.0 microns over the copper foil, wherein forming a dielectric comprises:
annealing at a temperature in the range of about 800-1050°C in an environment having an oxygen partial pressure of less than about 10^{-8} atmospheres, wherein the dielectric comprises at least one of barium
10 titanate and barium strontium titanate;
re-oxygenating the dielectric at a temperature in the range of about 450-700°C; and
forming a conductive layer over the dielectric, wherein the metallic foil, the dielectric, and the conductive layer form a capacitor.
- 15 24. A capacitor formed by the method of Claim 23.
25. A method of making a printed wiring board, comprising:
forming one or more capacitors using any of the methods recited in claims 1, 15 or 23;
laminating the one or more capacitors with one or more
20 laminate layers; and
forming connection circuitry, wherein the connection circuitry connects to one or more conductive layers or foils of the one more capacitors.
- 25 26. The method of Claim 25, wherein forming connection circuitry comprises:
forming one or more conductive vias.
27. The method of Claim 25, comprising:
connecting one or more conductive layers to a voltage pin of an integrated circuit by way of the connection circuitry.
- 30 28. The method of Claim 25, comprising:
etching one or more conductive layers before forming connection circuitry.
29. The method of Claim 28, wherein etching forms two separate electrodes from a conductive layer.
- 35 30. A printed wiring board formed by the method of Claim 25.